

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau(43) International Publication Date
5 June 2003 (05.06.2003)

PCT

(10) International Publication Number
WO 03/046306 A1(51) International Patent Classification:
E04B 7/20, E04C 2/292

E04D 3/35,

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(21) International Application Number: PCT/GB01/04941

(22) International Filing Date:
7 November 2001 (07.11.2001)

(25) Filing Language: English

(26) Publication Language: English

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UK LIMITED [GB/GB]; 30 Millbank, London SW1P
4WY (GB).(81) Designated States (national): AE, AG, AL, AM, AT, AU,
AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU,
CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH,
GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC,
LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW,
MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG,
SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN,
YU, ZA, ZW.(84) Designated States (regional): ARIPO patent (GH, GM,
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian
patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European
patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE,
IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF,
CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD,
TG).

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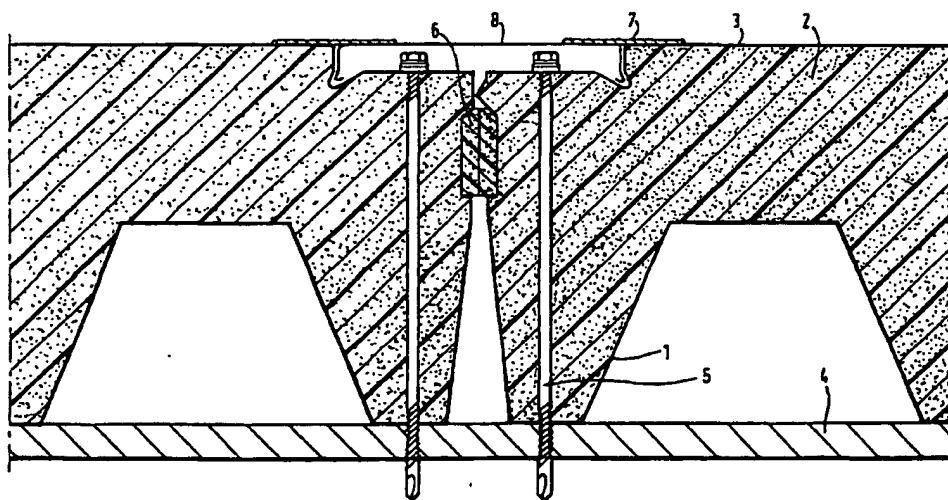
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Published:

— with international search report

[Continued on next page]

(54) Title: COMPOSITE WATER-RESISTANT PANELS



(57) Abstract: A composite panel comprising: a metal decking (1), optionally pre-coated with a decorative finish on its bottom surface a profiled metal top sheet (3) provided with a pre-laminated, waterproof, membranous layer on its top surface, an insulating layer (2) sandwiched between the top surface of the metal decking (1) and the bottom surface of the metal top sheet (3) and means (5, 7) for connecting the panel to a frame work (4) and/or another composite panel to form a substantially water resistant building or structure.

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COMPOSITE WATER-RESISTANT PANELS

This invention relates to composite panels, including but not strictly limited to panels for use in the construction of a flat roof. In particular, the invention relates to a prefabricated panel which can be conveniently and easily be fitted to a building or other construction, and a method for manufacture of such a panel.

Conventionally, flat roofs are built on site. The usual methods for manufacture involve the construction of a metal frame work onto which decking is layed and fixed. A layer of insulation is then applied and finally a waterproof layer must be added. The application of the water proof layer, in particular, can be a time consuming process. Typically this layer may be bonded, eg with hot asphalt or cold bitumen, or loose laid and ballasted with pebbles or concrete slabs. Alternatively, they may be mechanically fixed to the substrate.

Clearly in poor weather environments it is undesirable and inconvenient to have to carry out this multi-step process on site. Accordingly, the present invention aims to provide an article which can be manufactured in the factory and conveniently and easily located with a building or structure on-site.

In accordance with a first aspect the present invention, there is provided a composite panel comprising;

- a metal decking, optionally pre-coated with a decorative finish on it's bottom surface a profiled metal top sheet provided with a pre-laminated, waterproof, membranous layer on it's top surface,

- an insulating layer sandwiched between the top surface of the metal decking and the bottom surface of the metal top sheet and means for connecting the panel to a framework and/or another composite panel to form a substantially water resistant building or structure.

In accordance with a second aspect, the invention provides a method for the manufacture of a composite panel comprising:

- A. simultaneously roll-forming a metal sheet and a waterproof, membranous layer to provide a sheet laminate comprising a metal layer having a layer of waterproof, membranous material on it's top surface,
- B. roll-forming a second metal sheet, optionally applying a decorative coating to the bottom surface of the second metal sheet;
- C. arranging the first and second metal sheet with the top surface of said second sheet opposing the bottom surface of said first sheet; and
- D. providing therebetween, a volume of insulating material.

Optionally steps A and B may be carried out simultaneously. Step D may, optionally, be carried out by injecting a foaming polymeric insulating material between the arranged metal; sheets, and allowing the composite to cure. Alternatively, step D may involve spraying a chemical bonding agent to the top surface of said second sheet and the bottom surface of said first sheet and providing therebetween an insulating material. Insulating materials for use in accordance with the method may include, but are not strictly limited to; particle boards, mineral wool and polymeric foams. Optionally, to improve bonding between the insulating material and the two plates, the method may further include a step where pressure is applied to the composite. The pressure may be applied by means of, for example, a vacuum table, a platen press, a bag press or nip rolling while the bonding agent cures. Other means of improving or accelerating bonding of the plates to the insulating material will no doubt occur to the skilled addressee.

Suitable waterproof, membranous materials for use in accordance with the invention include vulcanised elastomeric materials which may be pre-cured, prior to applying the metal sheet and non-vulcanised elastomeric materials which are applied to the sheet in uncured form, being capable of curing while in service.

Some more specific examples of suitable waterproof membranous materials include; styrene butadiene modified bitumen, atactic polypropylene modified bitumen,

polyalphaolefin modified bitumen, ethylene propylenediene monomer, chlorosulphonated polyethylene, polyvinyl chloride, copolymer alloys, polyisobutylene, butadiene acrylonitrile alloys and nitrile butadiene polymers, ethylene interpolymers, polyepichlorohydrin, chlorinated polyethylene and neoprene(chloroprene). Suitable methods for applying these materials to the metal sheet will vary with the material to be used and will no doubt occur to the skilled addressee.

The metal sheeting may be profiled to meet the specific applications for which the panel is designed, for example, the bottom sheet may be castellated for use in roofing applications, to allow air circulation and/or the passing through of utility pipes and wires. The sides of either or both metal sheets may be suitably profiled to permit a convenient interlocking fit between sides of adjacent panels.

The panels have various applications, particularly where water impermeability is a desirable feature for a structure. By suitable adaption of the panels to suitable scales and shapes and/or the membranous sheet laminate, they may be used in the efficient assembly of, for example; flat roofing, flashings, gutters, portable buildings, flooring and walkways, ducting and air handling, water or silage tanks, oil rigs, swimming pools and pool ceilings, planters, lining of underground structures, overhead doors and secret fix roofing.

For the purposes of exemplification, some embodiments of the invention will now be further described with reference to the following Figures, in which;

Figure 1 shows a first embodiment of a composite panel of the invention for use in a flat roofing application;

Figure 2 shows a second embodiment of a composite panel of the invention for use in a flat roofing application;

Figure 3 shows a third embodiment of a composite panel of the invention for use

in a flat roofing application;

As can be seen from Figure 1, a composite roof panel according to the invention comprises a profiled metal decking 1 on its lower surface, a volume of injected polymeric insulating foam 2 filling a space defined between the profiled metal decking 1 and a metal top sheet 3 on the upper surface of the composite, the top sheet 3 having thereon a pre-laminated waterproof membranous material. The panel may mechanically fixed to a metal framework 4 for a roof, by fasteners 5. A foam thermal break 6 is fitted between adjacent panels mounted on the framework 4. A flat bracing piece 8 covers the top of the fasteners 5 is made watertight by heat or solvent welding waterproof cover strips, 7, along the joins connecting the bracing piece to the top sheets 3 of adjacent panels.

Figure 2 shows a broadly similar arrangement to that of Figure 1, in this embodiment, the insulating material 2 is provided in the form of a board of polymeric foam or mineral wool insulation. Also, the welded waterproof membrane cover strips, 7 are extended to cover the protruding tops of the fasteners 5.

Figure 3 shows a third, alternative embodiment of a roof panel according to the invention. In this panel, it can be seen the adjoining sides of two adjacent panels are suitably profiled to interlock, thereby reducing opportunity for leakage between joins. As in Figure 2, a cover strip 7 is extended to cover the top of a protruding fastener 5. As in figure 1, the insulation 2 is provided in the form of an injected polymeric foam.

Suitable means for applying waterproof membrane strips as referred to in this description will vary with the materials used, but some suitable methods include; seaming with adhesive or solvent welding, mechanical fastening and hot air welding. It is to be understood this list is not exhaustive and other suitable means will not doubt occur to the skilled addressee.

CLAIMS

1. A composite panel comprising;

a metal decking (1), optionally pre-coated with a decorative finish on its bottom surface a profiled metal top sheet (3) provided with a pre-laminated, waterproof, membranous layer on its top surface, an insulating layer (2) sandwiched between the top surface of the metal decking (1) and the bottom surface of the metal top sheet (3) and means (5, 7) for connecting the panel to a framework (4) and/or another composite panel to form a substantially water resistant building or structure.

2. A composite panel as claimed in claim 1 characterised in that the insulating layer comprises one or more of; particle board, mineral wool and polymeric foams.
3. A composite panel as claimed in claim 1 or claim 2 characterised in that the insulating layer is chemically bonded to the metal decking and/or the metal top sheet.
4. A composite panel as claimed in claim 2 characterised in that the insulating layer comprises polymeric foam injected into a space between the top surface of the metal decking and the bottom surface of the metal top sheet.
5. A composite panel as claimed in any preceding claim characterised in that the panel is configured for use in the construction of a flat roof.
6. A composite panel as claimed in any preceding claim characterised in that the panel is configured for use in the construction of guttering.
7. A composite panel as claimed in any preceding claim wherein the waterproof

membranous material is selected from; styrene butadiene modified bitumen, atactic polypropylene modified bitumen, polyalphaolefin modified bitumen, ethylene propylenediene monomer, chlorosulphonated polyethylene, polyvinyl chloride, copolymer alloys, polyisobutylene, butadiene acrylonitrile alloys and nitrile butadiene polymers, ethylene interpolymers, polyepichlorohydrin, chlorinated polyethylene or neoprene (chloroprene).

8. A method for the manufacture of a composite panel comprising:
 - A. simultaneously roll-forming a metal sheet and a waterproof, membranous layer to provide a sheet laminate comprising a metal layer having a layer of waterproof, membranous material on its top surface,
 - B. roll-forming a second metal sheet, optionally applying a decorative coating to the bottom surface of the second metal sheet;
 - C. arranging the first and second metal sheet with the top surface of said second sheet opposing the bottom surface of said first sheet; and
 - D. providing therebetween, a volume of insulating material.
9. A method as claimed in claim 8 characterised in that steps A and B are carried out simultaneously.
10. A method as claimed in claim 8 or claim 9 characterised in that step D involves injecting a foaming polymeric insulating material between the arranged metal sheets and allowing the composite to cure.
11. A method as claimed in claim 8 or claim 9 characterised in that step D involves spraying a chemical bonding agent to the top surface of said decking and the bottom surface of said top sheet and providing therebetween an insulating material.
12. A method as claimed in any of claims 8 to 11 characterised by the further step of applying pressure to the composite as it cures.

13. A method as claimed in claim 12 wherein the step of applying pressure involves the use of a vacuum table, a platen press, a bag press or a nip rolling apparatus.

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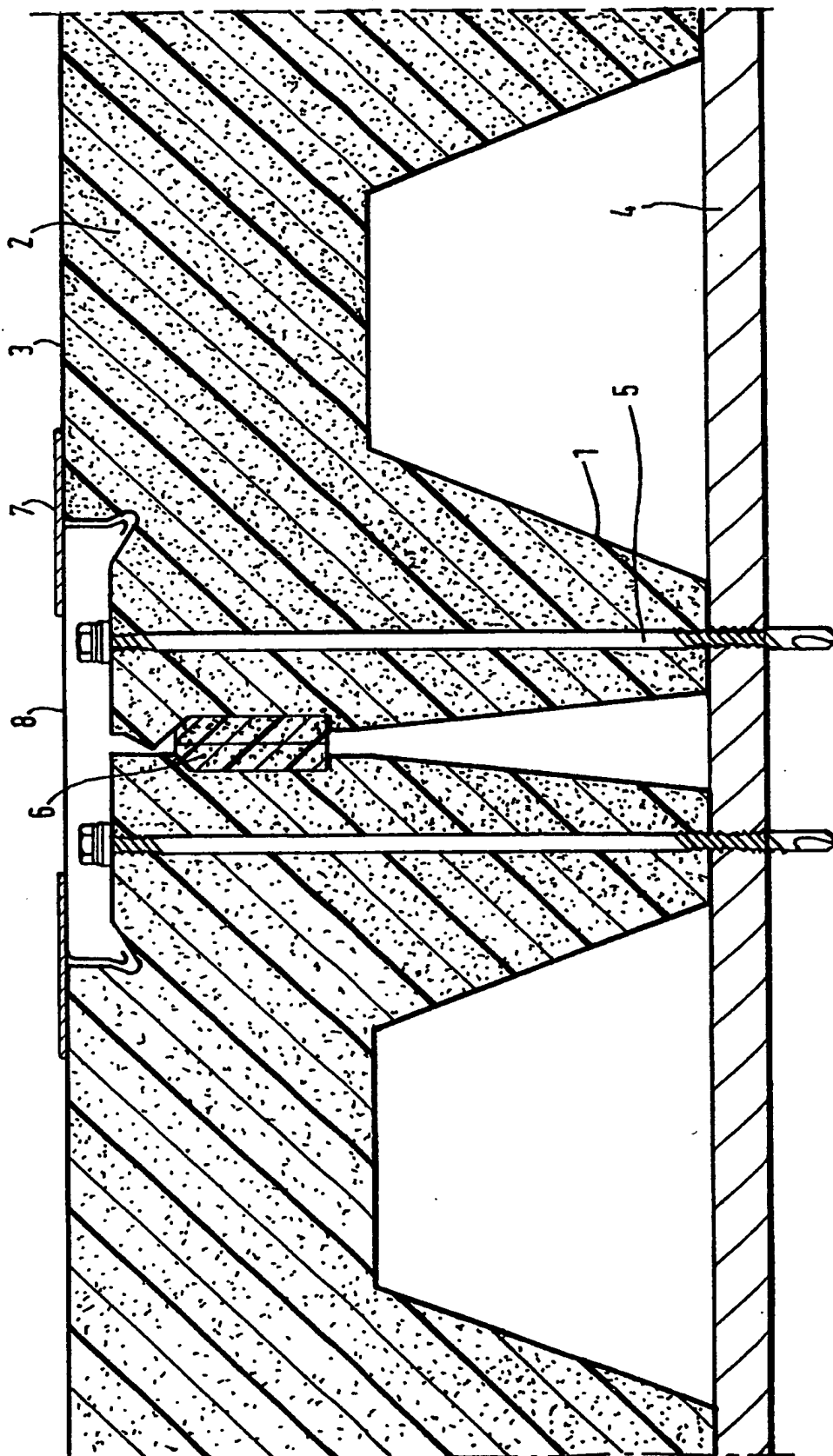
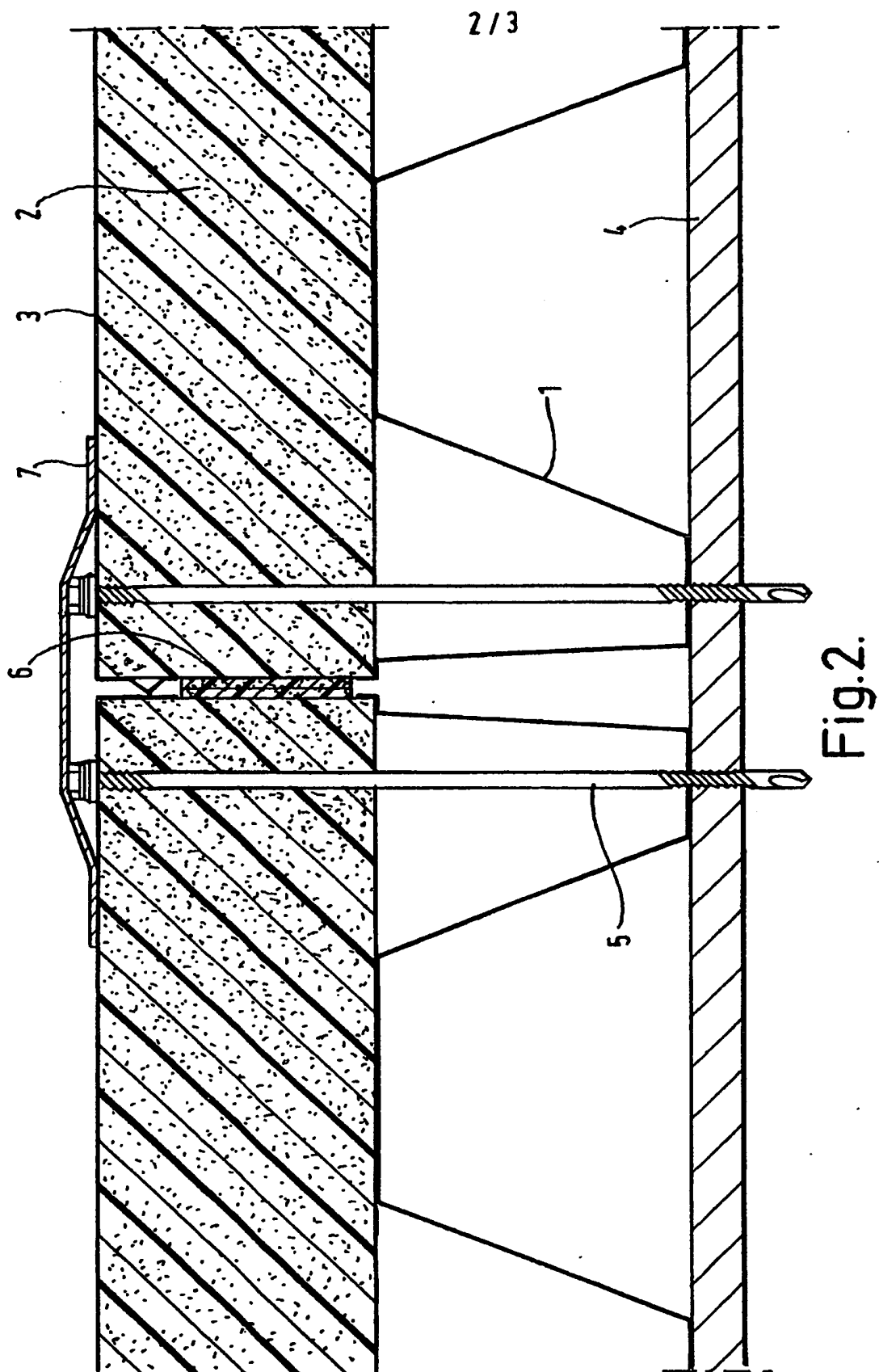


Fig.1.



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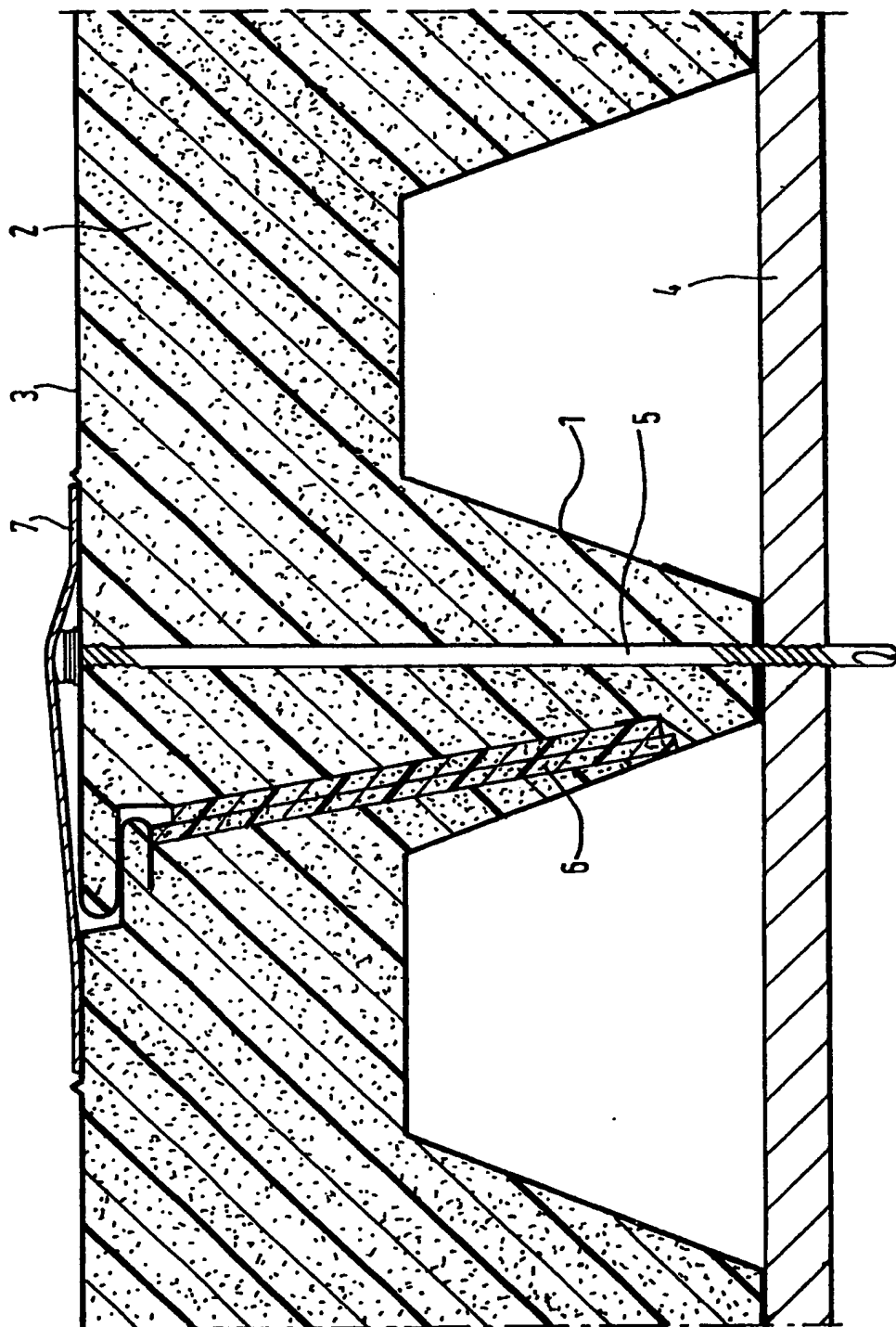


Fig. 3.

INTERNATIONAL SEARCH REPORT

Inte nal Application No
PCT/GB 01/04941

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 E04D3/35 E04B7/20 E04C2/292

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 E04D E04B E04C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

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Y	column 4, paragraph 2 -column 5, paragraph 1	3,11
A	column 8, paragraph 2 -column 9, line 60; figures 1-3,7-13	6,13
X	EP 0 409 513 A (PANELSPAN LTD) 23 January 1991 (1991-01-23)	1,2,5,6
A	abstract; figures 1,4	3,4,7-13
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A	page 2, line 2 -page 4, line 24; figures	1,2,4-6, 8,10,12, 13

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Date of the actual completion of the international search

16 August 2002

Date of mailing of the international search report

30 AUG 2002

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